# VACUUM CLEANER BRUSHROLL

## TECHNICAL FIELD

The present invention relates to a vacuum cleaner, and more particularly, to a vacuum cleaner brushroll.

## BACKGROUND OF THE INVENTION

A vacuum cleaner picks up dirt and debris by generating a vacuum and therefore an airflow that picks up the dirt and debris. The vacuum cleaner filters the dirt out of the airflow and retains the dirt in a collection chamber. Consequently, the efficiency and usefulness of a vacuum cleaner is determined by how well it picks up dirt and debris. Furthermore, the efficiency and usefulness is determined by how well it picks up dirt and debris from a variety of underlying surfaces.

Advances in vacuum cleaners have resulted in the inclusion of a brushroll that includes bristles. The bristles are formed in tufts and rows of tufts during manufacture. The brushroll is powered in some manner, and rotates so that the bristles pick up the dirt from an underlying surface. As a result, the powered brushroll improves the cleaning ability of the vacuum cleaner by dislodging the dirt and propelling the dirt into the airflow. The brushroll is especially advantageous on uneven or rough surfaces, such as carpet, for example, wherein the bristles help to pull dirt out of the carpet fibers.

FIG. 1 shows a prior art brushroll having bristle tufts of a uniform effective length L from the brushroll body. This type of prior art brushroll is disclosed in U.S. Patent No. 4,307,479 to Mertes et al., and in U.S. Patent No. 6,574,823 to Stegens. Here, the tips of the bristles are a uniform distance from the brushroll body and therefore have a uniform effective tuft length.

While this type of tuft is effective for cleaning a particular surface, a problem with a uniform effective length tuft is that it is not equally effective for other surfaces. For example, while a dense and short tuft works well for aggressively cleaning carpet, a short, dense tuft may be too rough and aggressive for cleaning wood floors or surfaces that can be marred or dulled. On a hard surface, aggressive tufts can over-propel dirt up and off of the surface, while an aggressive tuft may be necessary to pull dirt out of deep carpet and propel it into the vacuum

cleaner airflow. In addition, in deep carpet, the wheels of the vacuum cleaner sink in, and a short tuft can reach the underlying surface, while the same tuft will likely not reach a hard surface.

FIG. 2 shows another prior art brushroll having two rows of bristles, with one row being longer than the other. This type of prior art brushroll is disclosed in U.S. Patent No. 5,452,490 to Brundula et al. In use, when the brushroll of Brundula is rotating, the lagging tuft will immediately follow the preceding tuft in contact with the underlying surface. A disadvantage of this prior art approach is that twice as many rows are needed to create a brushroll having two effective tuft lengths. This may be difficult and expensive when manufacturing a small brushroll. Another disadvantage is that when the longer tuft contacts the underlying surface, it will likely flex backwardly and obscure the shorter, following tuft.

FIG. 3 shows yet another prior art brushroll having a non-radially oriented tuft, with the bristles of the tuft being of different lengths. This type of prior art brushroll is disclosed in U.S. Patent No. 6,530,106 to Brundula et al. This tuft orientation achieves a tuft having bristles of various effective lengths. However, disadvantageously, because the bristles are not radially-oriented, the stiffness of the bristles is reduced. By being angled with respect to a radius of the brushroll, the bristles will flex more readily than a radially-oriented bristles. In addition, the tips of the bristles will make less contact with the underlying surface, with the result being that a bristle will be pulled somewhat lengthwise over the underlying surface. The result is a less aggressive tuft.

## SUMMARY OF THE INVENTION

A vacuum cleaner brushroll according to an embodiment of the invention comprises a brushroll body and at least one row of bristle tufts disposed on the brushroll body. The at least one row of bristle tufts comprises a first tuft of a first effective length from the brushroll body and at least a second tuft of a second effective length that is different from the first effective length.

A vacuum cleaner brushroll according to an embodiment of the invention comprises a brushroll body and at least one row of substantially radially-outwardly oriented bristle tufts disposed on the brushroll body. A particular tuft of the at least one row comprises first bristles of a first effective length from the brushroll body and at least second bristles of a second effective length that is different from the first effective length.

A method of forming a vacuum cleaner brushroll according to an embodiment of the invention comprises providing a brushroll body and providing at least one row of bristle tufts disposed on the brushroll body. The at least one row of bristle tufts comprises a first tuft of a first effective length from the brushroll body and at least a second tuft of a second effective length that is different from the first effective length.

A method of forming a vacuum cleaner brushroll according to an embodiment of the invention comprises providing a brushroll body and providing at least one row of substantially radially-outwardly oriented bristle tufts disposed on the brushroll body. A particular tuft of the at least one row comprises first bristles of a first effective length from the brushroll body and at least second bristles of a second effective length that is different from the first effective length.

## BRIEF DESCRIPTION OF THE DRAWINGS

The same reference number represents the same element on all drawings. It should be noted that the drawings are not to scale.

FIG. 1 shows a prior art brushroll having bristle tufts of a uniform effective length L from the brushroll body;

FIG. 2 shows another prior art brushroll having two rows of bristles, with one row being longer than the other;

FIG. 3 shows yet another prior art brushroll having a non-radially oriented tuft, with the bristles of the tuft being of different lengths;

FIG. 4 shows a brushroll according to an embodiment of the invention;

FIG. 5 is an end view of a brushroll according to another embodiment of the invention;

FIG. 6A is a front view of a brushroll according to another embodiment of the invention;

FIG. 6B is an end view of the brushroll of FIG. 6A, wherein it can be seen that the bristles of the tuft are substantially radially oriented; and

FIG. 7 shows a brushroll according to another embodiment of the invention wherein the rows of tufts are arranged on the brushroll body in a substantially helical manner.

## DETAILED DESCRIPTION OF THE INVENTION

FIG. 4 shows a brushroll 100 according to an embodiment of the invention. The brushroll 100 includes a brushroll body 101, first tufts 103, and second tufts 104. The first tufts

103 and second tufts 104 are formed in a row on the brushroll body 101. Only one row is shown for the purpose of clarity, but it should be understood that multiple rows can be formed on the brushroll body 101.

In one embodiment, the row is substantially linear, as shown. Alternatively, a row can be substantially helically disposed on the brushroll body 101 (see row 106 of FIG. 7, for example).

In the embodiment shown, the first tufts 103 are of a first effective length $L_1$ and the second tufts 104 are of a second effective length $L_2$ that is different than the first effective length. For example, in one embodiment the first effective length $L_1$ can be about 0.4 inch and the second effective length $L_2$ can be about 0.275 inch. However, it should be understood that other lengths can be employed. Consequently, the first tufts 103 will contact the underlying surface in applications where the surface is relatively hard and flat, or where the vacuum cleaner height is at a high setting. It should be understood that tufts of more than two effective lengths can be used.

The first tufts 103 will typically always be in contact with the underlying surface. A typical application is in vacuuming a hardwood floor or other relatively flat, hard surface. In this manner, the first tufts 103 will pick up dirt and debris, but without excessive contact with the underlying surface in order to minimize contact and prevent damage or wear.

In contrast, the second tufts 104 will contact the underlying surface only at high spots of an irregular underlying surface, when the vacuum cleaner height is at a low setting, or when the vacuum cleaner is used on and sinks down into a soft underlying surface, such as carpet. It should be noted that the vacuum cleaner height setting can determine whether the second tufts 104 contact the underlying surface. The second tufts 104 will typically be brought into contact with the underlying surface when a more aggressive bristle action is desired, such as in carpet cleaning or for picking up heavy dirt or large debris. Alternatively, the second tufts 104 can be chosen to be less aggressive than the first tufts 103, if desired.

The first tufts 103 and second tufts 104 can be additionally varied in other respects. The first tufts 103 can be of a first diameter and the second tufts 104 can be of a second diameter that is different from the first diameter. It is known that the bristle diameter affects the bristle stiffness. Therefore, by varying the diameter, the relative stiffness of the first tuft 103 and second tuft 104 can be controlled. Any variation in diameter will therefore contribute the stiffness and aggressiveness of the tuft, and can be selected to make the first tufts 103 more or

less aggressive than the second tufts 104, for example. In one example, both the first tufts 103 and second tufts 104 are about 0.010 inch in diameter.

In one embodiment, the bristles of both the first tufts 103 and second tufts 104 are formed of nylon. Alternatively, the first tufts 103 can be formed of a first material and the second tufts 104 can be formed of a second material that is different from the first material. The material used for the bristles can likewise affect the stiffness of the tufts, and can be selected to affect the relative stiffness of the first tufts 103 and second tufts 104. It should be understood that the bristles of any embodiment of the invention can use either man-made or natural materials.

In another variation, the first tufts 103 can be formed of a first color and the second tufts 104 can be formed of a second color that is different from the first color. The color can include a bristle of any color or a clear bristle. The colors of the first tufts 103 and second tufts 104 can be selected to be different in order to visually differentiate the first tufts 103 from the second tufts 104. For example, in one embodiment the first tufts 103 can be green and the second tufts 104 can be clear.

In yet another variation, the first tufts 103 can be formed of a first number of bristles and the second tufts 104 can be formed of a second number of bristles that is different from the first number of bristles. The number of bristles used to form the first tufts 103 and second tufts 104 can be selected in order to vary the stiffness of the first tufts 103 from the second tufts 104. For example, in one embodiment the first tufts 103 can include more bristles, and can as a result be stiffer than, the second tufts 104.

FIG. 5 is an end view of a brushroll 500 according to another embodiment of the invention. In this embodiment, the first tufts 103 are longer than the second tufts 104 and have a longer effective length. In addition, the first tufts 103 and the second tufts 104 are angled with respect to a radius direction of the brushroll body 101. It should be understood that either the first tufts 103, the second tufts 104, or both can be angled.

In one embodiment, the first tufts 103 are angled at a first angle and the second tufts 104 are angled at a second angle that is different from the first angle. The first and second angles can be in opposite directions, as shown, or can be angled in the same direction. Alternatively, in another embodiment the first and second angles are of the same magnitude and direction.

In another embodiment, the first tufts 103 and second tufts 104 of FIG. 5 can be in first and second rows. The rows can include straight rows (shown), helical rows, etc., of straight

(radially outwardly oriented) and/or angled tufts. It should be understood that the first tufts 103 and second tufts 104 of FIG. 4 can be angled as shown in this figure, and can comprise one row or two rows.

FIG. 6A is a front view of a brushroll 600 according to another embodiment of the invention. In this embodiment, each tuft 105 includes bristles of the first effective length $L_1$ and bristles of the second effective length $L_2$. An individual tuft 105 therefore can perform substantially the same as the first tufts 103 and second tufts 104 of the previous embodiment, and can accommodate both smooth and uneven surfaces. Consequently, the tuft 105 can include both gentle and aggressive bristle components. It should be understood that bristles of more than two effective lengths can be used. It should also be understood that the bristles of various lengths can be used in any ratio.

As before, the tufts 105 can be arranged in a row. The brushroll 600 includes one or more rows, and the rows can be arranged substantially linearly or substantially helically. As before, the tufts 105 can be substantially radially-outwardly oriented from the brush body 101, or can be angled with respect to a radius direction of the brushroll body 101.

FIG. 6B is an end view of the brushroll 600 of FIG. 6A, wherein it can be seen that the bristles of the tuft 105 are substantially radially-outwardly oriented. By positioning the bristles in a substantially radially-outward orientation, the stiffness of the individual bristles is not compromised or lessened.

FIG. 7 shows a brushroll 700 according to another embodiment of the invention wherein a row or rows of tufts 106 are arranged on the brushroll body 101 in a substantially helical manner. The tufts of the row 106 can comprise the first tufts 103 and second tufts 104 of FIGS. 4 or 5, or can comprise the tufts 105 of FIG. 6.

The vacuum cleaner brushroll according to any embodiment of the invention provides several benefits. The brushroll simultaneously provides both gentle and aggressive brushroll bristles and/or tufts. The brushroll provides shorter and/or aggressive tufts for improved dirt pickup on rough or fibrous surfaces. The brushroll provides longer and/or less aggressive tufts for improved dirt pickup on hard, smooth surfaces, but without marring or dulling the surface. In addition, the vacuum cleaner brushroll provides varying bristle lengths to accommodate changing distances to the underlying surface.